XLIX.—*Report on Dredging among the Hebrides.*

By J. Gwyn Jeffreys, F.R.S.

[As this Report embodies important and recent papers by Professors Sars and Lovén, on the existence of animal life in great depths of the sea, which do not appear to be known in this country, I thought the subject would be sufficiently interesting to publish it at once in this form, without waiting for the appearance of the annual Report of the British Association for the Advancement of Science.—J. G. J.]

This exploration lasted nearly two months, viz. from the 24th of May to the 14th of July in the present year. It comprised Sleat Sound, Lochs Alsh, Duich, Slapin, and Scavaig, and the Minch from Croulin Island to Loch Ewe. I had a good cutter yacht, the master of which had been employed by me for many years as dredger and took considerable interest in the work, an active and willing crew, four serviceable dredges, 300 fathoms of new rope, machinery for hauling up the dredges, a large tub, sieves, and various other apparatus. The Hydrographer of the Navy obligingly supplied me with such charts as I required, to show the depths and nature of the sea-bottom in the district which I proposed to examine; and these were of great use in dredging, as well as for navigation. The weather was too fine; we were often becalmed for many hours together: and instead of steady breezes, we had too many of those squalls which are so prevalent, and occasionally dangerous, in the Hebrides.

The Hebridean seas have often been searched, but not explored, by zoologists. Their great extent, and the number of lochs and inlets which indent the coast in every direction, would render necessary an immense deal of money, time, and patience for a complete investigation. There is little probability that the subject of the present Report will ever be exhausted.

The invertebrate fauna of this district is of a northern character, although there are a few exceptions. Such are, among the Mollusca, *Trochus umbilicatus*, *Phasianella pulla*, *Rissoa cancellata* or *crenulata*, *Odostomia lactea* or *Chemnitzia elegantissima*, and *Pleurobranchus plumula*. These may be regarded as southern forms. The first and third occur as far north as Stornoway; the second ranges to Dunnet Bay in Caithness; of the fourth I dredged a single specimen in the upper part of the Minch; and the last lives between tide-marks in the Isle of Mull. As a set-off to the above, I would mention the following species, which have now for the first time been found so far south as the Hebrides, viz. *Montacuta tumidula* (a new species, which I will presently describe), *Trochus occidentalis*, var. *pura*, *Jeffreysia globularis*, and *Odostomia eximia*. The first is Swedish; the

second is Zetlandic, Scandinavian, and North American, although it has also been procured in the Orkneys and on the Aberdeenshire coast; the third is Zetlandic, and the fourth Zetlandic also and Norwegian. It must be borne in mind, as regards the extent of geographical distribution, that the southern extremity of the Shetland Isles is distant about 200 miles from the northern extremity of the Hebrides "as the fish swims." Besides the four last-named species, the following seem to reach their most southern limit in the Hebrides:—*Lima elliptica, Leda pygmæa,* and *Trochus Grœnlandicus. Leda pygmæa* has indeed been dredged on the coast of Antrim; but I am now inclined to regard the specimens thus obtained as quaternary fossils. *Tethea cranium* (a sponge not before known south of Shetland) occurred in tolerable numbers on the Ross-shire side of the Minch. Species of Mollusca, inhabiting the Hebridean seas, which are in the main northern (although they have been found somewhat further south, and some of them occasionally even in the Mediterranean), are—*Argiope cistellula, Pecten striatus, Mytilus phaseolinus, Modiolaria nigra, Crenella decussata, Nucula tenuis, Leda minuta, Arca pectunculoides, Montacuta ferruginosa, Cyamium minutum, Cardium minimum, Cyprina Islandica, Astarte compressa, Tellina pusilla, Scrobicularia nitida, Thracia convexa, Mya arenaria, M. truncata, Chiton Hanleyi, C. albus, C. ruber, C. marmoreus, Tectura testudinalis, T. fulva, Propilidium ancyloides, Puncturella Noachina, Emarginula crassa, Scissurella crispata, Trochus helicinus, Lacuna divaricata, L. puteolus, L. pallidula, Rissoa albella, Jeffreysia diaphana, J. opalina, Odostomia minima, O. albella, O. insculpta, O. diaphana, Velutina plicatilis, V. lævigata, Trichotropis borealis, Purpura lapillus, Buccinum undatum, Trophon Barvicensis, T. truncatus* or *Banffius, Fusus antiquus, F. gracilis, Nassa incrassata, Mangelia turricula, Defrancia scabra, Cylichna nitidula, Amphisphyra hyalina, Philine scabra, P. pruinosa,* and *P. quadrata.*

For certain species, which are almost peculiar to the Hebrides, I am not aware that any locality has been recorded between that district and the Mediterranean. Such are *Axinus ferruginosus, Poromya granulata, Neæra abbreviata, N. costellata,* and *Cylichna acuminata.* The first three of these were described by the late Professor Edward Forbes, in the Report to the Association in 1843 on Ægean Invertebrata. Another Hebridean species (*Nucula sulcata*) is not found southwards nearer than the coast of Spain.

Some of our most conspicuous and prized shells, that are also of a northern type, are wanting in the Hebrides. *Saxicava Norvegica, Natica Grœnlandica, Buccinum Humphreysianum, Buccinopsis Dalei, Fusus Norvegicus, F. Turtoni,* and *F. Berni-*

ciensis are in this category. All the above (with the exception of *Buccinum Humphreysianum*, which inhabits Shetland and the coasts of county Cork) are met with on the Dogger bank; and the first two are fossil in the Clyde beds. Six out of the seven being univalves, I would venture to surmise that their non-existence in the western seas of Scotland may have arisen from the circumstance that the diffusion of univalves is slower than that of bivalves. The spawn of the former is attached to the spot where it is shed, or in a few cases (e. g. *Capulus* and *Calyptræa*) it is hatched within the shell of its sedentary parent; so that the fry forms a colony, and need not roam to any distance, provided their station yields a sufficient supply of food and has the other requisites of habitability. Not so with bivalves. These shed their ova into the water, or else (as in some of the *Kellia* family) hatch them within the folds of the mantle, whence they are excluded on arriving at maturity. Their fry swim freely and rapidly by means of numerous encircling cilia. The metamorphic state lasts many hours. During that period they can voluntarily traverse considerable distances, or they may be involuntarily transported by tidal and oceanic currents. Time is the only element necessary for their widest dispersion over the adjacent seas, if no barrier intervenes. Should, however, such an obstacle present itself, whether in the shape of previously existing dry land, like that which separates the North Sea from the Atlantic, or from an upheaval and drying-up of the neighbouring sea-bed by geological or cosmical causes, the further diffusion of any marine animals in that direction must necessarily be stopped. An opposite result would doubtless be produced by a sinking and submersion of dry land below the level of the sea, whereby the diffusion of such animals would be greatly facilitated. This appears to have been the fluctuating course of events since the formation of the Coralline Crag, which was probably the cradle or starting-point of our molluscan fauna—a period long antecedent to the last glacial epoch, and incalculably far beyond the advent of man, unless his origin is much more remote than it is at present supposed to be. I am not inclined to attribute the northern character of some of the Hebridean mollusca to the persistence of what have been called "boreal outliers." The idea savours more of poetry than of philosophy or fact. The boreal or truly arctic species which once flourished in this district have become quite extinct, probably in consequence of one of those revolutions above suggested, by which the sea-bed was converted into dry land. These boreal species consist chiefly of *Rhynchonella psittacea*, *Pecten Islandicus*, *Astarte crebricostata* or *depressa*, *Tellina calcaria*, *Mya truncata*, var. *Uddevallensis*, *Trochus cinereus*, and *Astyris Holböllii*; and I have lately, as well as on a former

occasion, dredged them on the coasts of Skye and West Ross, at depths of from 30 to 60 fathoms, or 180–360 feet. They had a semifossilized appearance. Not one of the above-named species has ever, to the best of my knowledge and belief, been found in a living or recent state in any part of the British seas. All of them occur in post-tertiary or quarternary deposits on the west coast of Scotland, from a few feet above high-water mark* to 320 feet above the present level of the sea†. The greatest subaërial height (320 feet) being added to the greatest submarine depth as above (360 feet), gives an extent of elevation and subsidence equal to 680 feet. But as *Pecten Islandicus*, for example, now inhabits the arctic ocean at depths varying from 5 to 150 fathoms, let us take the average of these depths, viz. 77½ fathoms or 465 feet, and add it to the 680 feet. This would make 1145 feet, and probably represent the height at which the sea-level may be supposed to have stood when *P. Islandicus* lived on the highest fossiliferous spot noticed by Mr. Watson. The non-fossiliferous boulder-clay, indicating the simultaneous presence of arctic land which was also subject to glacial conditions, is stated by Mr. Watson‡ to be about 800 feet higher than the marine deposit. The height of the layer of sea-shells on Moel Tryfaen in Carnarvonshire (evidently the remains of an ancient beach) exceeds that of the similar deposit at Cardigan by more than 1300 feet; and the difference of height observed in the case of other fossiliferous deposits in the north of England (*e. g.* Manchester and Kelsey Hill) shows that the disturbing movement has been unequal, and probably not synchronous, over the same area. It would seem that the extent of such oscillation has not altogether amounted to 2000 feet in the British Isles, taking Moel Tryfaen as the greatest height, and the Shetland sea-bed as the greatest depth at which quaternary shells of recent species occur. The Scotch and Irish deposits, however, are on the whole far more ancient than those of Wales and England, judging from their geographical nature; the former are chiefly arctic, and the latter merely northern. Whether other parts of the North Atlantic sea-bed have undergone a much greater change of level since the tertiary epoch is not so well established. Dr. G. C. Wallich, in his admirable and philosophical treatise§, with which all marine zoologists and geologists are, or ought to be, familiar, believed that certain starfishes which he

* British Association Report, 1862, Trans. Sect. p. 73 : Jeffreys, "On an Ancient Sea-bed and Beach near Fort William, Inverness-shire."

† Transactions of the Royal Society of Edinburgh, 1864, p. 526 : Rev. R. B. Watson, "On the Great Drift-beds with Shells in the South of Arran."

‡ *Loc. cit.* p. 524.

§ The North Atlantic Sea-bed, 1862.

had procured at a depth of 1260 fathoms (7560 feet) in lat. 59° 27′ N., long. 26° 41′ W., about halfway between Cape Farewell and the north-west coast of Ireland, were originally a shallow-water species, but had gradually, and through a long course of generations, accommodated themselves to the abnormal conditions incident on the subsidence of the sea-bed*. The starfishes in question, which he refers to the *Ophiocoma granulata* of Forbes (*Asterias nigra* of O. F. Müller), appear, however, to belong to a different species, which inhabits deep water. In an important paper by Professor Sars, on the distribution of animal life in the depths of the sea†, he states that *Ophiocoma nigra* (*O. granulata*, Forbes) is certainly found in shallow water, viz. from 2 to 30 fathoms, on the coast of Norway, but never at a greater depth so far as is yet known, and that it does not range north of the firth of Drontheim. He is of opinion that Dr. Wallich's species is *Ophiacantha spinulosa* of Müller and Troschel, a well-known and Grœnlandic species, which is not littoral, but rather a deep-water kind, viz. from 20 to 190 fathoms; and he infers from Wallich's own account that the last-named species, instead of *Ophiocoma nigra* or *granulata*, was the one taken by the 'Bulldog'-sounding in 1260 fathoms. Dr. Wallich also adduces his discovery, at a depth of 682 fathoms (4092 feet), in lat. 63° 31′ N., long. 13° 41′ W., of two testaceous Annelids, which he assumed to belong to "known shallow-water forms," as further evidence of an extensive submergence of the North Atlantic sea-bed. These Annelids were named by him *Serpula vitrea* and *Spirorbis nautiloides*. But Professor Sars disputes their being shallow-water species. The former he identifies with his *Serpula polita* (= *Placostegus tridentatus*, Fabricius); the latter is referred by Mörch‡ to the *Serpula spirorbis* of Linné. The one is regarded by Sars as a deep-water and not littoral species, being found on the Norwegian coast in 20 to 300 fathoms; the other has a wide bathymetrical range, from low-water mark to 300 fathoms. I suspect, moreover, that there has been some mistake in the determination of the *Spirorbis*, and that it belongs to another species than that to which Wallich has assigned it. As to the accuracy of his statement that he procured living starfishes from a depth of 1260 fathoms, under the circumstances which he has described (viz. "convulsively embracing a portion of the sounding-line, which had been paid out in excess of the already ascertained depth, and rested for a sufficient period at the bottom to permit of their attaching themselves to it"), no reasonable

* *Loc. cit.* p. 41.

† Vid.-Selsk. Forhandl. 1864: Hr. Sars, "Bemærkninger over det dyriske Livs Udbredning i Havets Dybder."

‡ Naturhist. Tidsskr. 1863: "Revisio critica Serpulidarum."

doubt can be entertained. I have myself seen a number of *Antedon* (or *Comatula*) *celticus* clinging to the rope several feet from the dredge when it was taken up from about 60 fathoms. These starfishes must have crawled up the rope while the dredge was in motion or being hauled in, because no part of the rope had lain on the ground. Dr. Carpenter tells me that *Antedon rosaceus* has the same habit of crawling up and clasping a rope in shallow water.

The greatest depth marked on the Admiralty charts in any part of the Hebridean sea-bed which I examined is 132 fathoms. Here I got several kinds of living Foraminifera. Nineteen years ago I dredged near the same ground, in 116 fathoms, a fine cluster of one of the compound Tunicata, *Diazona Hebridica*, of a greenish-pink colour. I do not mention this as a great or even considerable depth. Sars* and Koren† have done much more on the coasts of Norway; their dredging-explorations extended to 300 fathoms. In the paper from which I have extracted the above remarks as to the distribution of animal life in the depths of the sea, Professor Sars has enumerated no less than 52 species and distinct varieties of animals found by him at the depth of 300 fathoms. They may be thus classified:— Porifera (Sponges) 2; Rhizopoda (Foraminifera) 19; Polypi (Actinozoa) 7; Mollusca (Polyzoa 8, Tunicata 1, Mollusca proper 10) 19; and Vermes (Annelida) 5. He has also specified several Echinoderms, Cirripeds, and Crustacea, as inhabiting somewhat less depths, viz. from 200 to 250 fathoms. The observations of the learned Norwegian zoologist confirm those of Sir James Ross and Dr. Wallich, namely:—

1st. That the temperature of the sea is uniform (39°·5 Fahr.) over the whole globe, below a certain line which forms an isothermal curve, with but slight oscillations caused by changes of the atmosphere. This curve has its greatest depth at the Equator, but reaches the surface of the ocean in lat. 56° 62′, and dips again as it approaches the pole from this point.

2nd. Although the pressure of the water is enormous at great depths, and in 300 fathoms is equal to about 56 atmospheres or 840 lbs. on the square inch‡, yet the most brittle and delicate animals (such as Polyzoa and Polyps) inhabiting such depths do not appear to suffer the slightest injury. Their structure is porous and permeable by liquids, or accessible to an endosmotic influence by which the pressure is easily resisted.

* Reise i Lofoten og Finmarken, 1849.

† Nyt Mag. Naturw. 1856.

‡ The Norse skaalpund is 10 per cent. more than the English lb. avoirdupois. Sixteen Norwegian square inches are equal to seventeen English square inches.

3rd. The want of light has always been considered an obstacle to the existence of animal life at great depths—not so much because light is directly essential to animal life, as on account of its indirectly contributing to its maintenance. It is generally supposed that animals are dependent on vegetable life. This latter, as is well known, cannot exist without light, under the influence of which the absorption of carbonic acid and the evolution of oxygen are effected. Light, however, exerts no such influence on animal life. Sea-weeds (the true Algæ) disappear in about 200 fathoms; and the only vegetable organisms which descend to a greater depth, say 400 fathoms, are Diatomaceæ. It may be observed, with respect to the action of light in producing colour in animals, that although intensity of light may produce a corresponding intensity of colour under ordinary circumstances, yet the diminution or absence of light in the sea is not necessarily followed by a diminution or absence of colour in marine animals. Those taken from considerable depths have frequently vivid colours. The animal of *Lima excavata* (a comparatively gigantic species), from 300 fathoms, is of the same bright red colour as those of *L. Loscombii* and *L. hians* from shallow water. It has been shown that red rays of light (*i. e.* actinic contradistinguished from luminous rays) penetrate deepest in the water. I will not here repeat what I have already published* on this interesting subject; but I may add that all the animals recorded as living at great depths are zoophagous, none of them phytophagous. The deep-sea dredgings of the Swedish Expedition to Spitzbergen in 1861 yielded some valuable results. Adjunct Professor Thorell and Professor Keferstein communicated some short and imperfect notices to the northern journals; but Professor Lovén has lately given us fuller information, which is published in the 'Transactions of Scandinavian Naturalists' at their ninth meeting held in 1863†. A Brooke's lead and a 'Bulldog' machine, with several improvements, were used on this occasion. Depths from 6000 to 8400 feet (1000–1400 fathoms‡) were thus explored. The sea-bottom at these depths was covered with a fine greasy-feeling material of a yellow-brownish or grey colour, rich in Diatomaceæ§ and Polythalamia, and nearly devoid of sand. Professor Lovén was furnished with the notes of

* British Conchology, vol. i. Intr. pp. xlviii–l, and vol. ii. Intr. pp. viii–xi.

† Stockholm, 1865 : p. 384.

‡ The Swedish foot makes only 0·974 English foot. The Scandinavian fathom is 6 feet.

§ This does not quite agree with the accounts of Wallich and Sars, which give 400 fathoms as the limit of vegetable life; but it does not appear that the Diatomaceæ observed by Lovén had actually lived on the sea-bottom. They might have been pelagic and floating kinds.

Messrs. Chydenius and Malmgren, made during the expedition, and with all the animals discovered in those great depths. The latter comprised:—Annelida, viz. species of *Spiochætopterus* and *Cirratulus*; Crustacea, viz. a *Cuma* which appeared to be identical with *C. rubicunda*, Lilljeborg, and an *Apseudes*; Mollusca, viz. a *Cylichna*; Gephyrea, viz. a fragment of *Myriotrochus Rinki*, Steenstrup, and another allied form with large and fewer star-wheels, and of smaller wheels of the *Myriotrochus*-type; a species of *Sipunculus* resembling *S. margaritaceus*, Sars; and, lastly, a sponge, in which were found a Copepod or Ostracod, and a fragment of a *Cuma* resembling *C. nasica*. In the opinion of Lovén these animals indicate, so far as can be judged by so small a number, that in the abysses of the glacial seas there lives a fauna which does not greatly differ from that which lives on the same kind of bottom at much less depths. Proceeding upwards to the surface, from 50 or 60 fathoms the regions or zones have a greater variety of animals, even over the same kind of bottom. Taking this into consideration, and also recollecting that in the Antarctic seas, at measurable depths, there are forms of Mollusca and Crustacea which exhibit partly generic, partly almost specific identity with northern and hyperborean forms, the idea occurs to him that, from 60 or 80 fathoms down to the greatest depth known to be inhabited by animals, the bottom is everywhere covered with a soft and fine mud or clay, and that there exists from pole to pole, in all latitudes, a deep-sea fauna of the same general character, many species of which have a very wide distribution. He also thinks it probable that in the vicinity of both poles such a uniform fauna approaches the surface; while in tropical seas it occupies the depths of the ocean, the coast-line there being represented by vast regions of distinct faunas, the circumferences or areas of which are much more limited. But, in the face of the discovery made by Professor Sars that large Brachiopoda, stony corals, and Polyzoa, as well as certain Mollusca (e. g. *Anomia* and *Saxicava*) which are peculiar to a hard or even to a rocky bottom, inhabit a depth of 300 fathoms, and seeing that Dr. Wallich found a living *Serpula* attached to a stone at the depth of 682 fathoms, I am not prepared to accept, without considerable qualification, Professor Lovén's notion that the sea-bottom from 60 or 80 fathoms downwards is everywhere formed of soft material; indeed we need not go far from home to seek a refutation of this idea. Captain Beechey's dredgings off the Mull of Galloway, in 145 fathoms (as reported by the late Mr. Thompson, of Belfast, in the 'Annals and Magazine of Natural History' for September 1842, p. 21), yielded live specimens of *Chiton fascicularis, C. cinereus, Trochus millegranus,* and *Trophon Barvicensis,* all of which are inhabitants of hard or

stony, and never of soft ground, besides dead shells of the same and similar species. That is more than twice the average depth supposed by Professor Lovén to be the limit of hard ground. The Hebridean sea-bed, at very moderate depths (which Dr. Wallich would call "shallow water"), mainly consists of a soft and more or less tenacious mud, mixed with stones of different sizes, and resembling in its composition the boulder-clay or glacial drift of Scotch geologists. It tells us of rocks ground down by glaciers year after year in an arctic region—of the mud produced by such attrition being carried into the sea in the thawing-season by overwhelming floods, "non sine montium clamore" (see Dr. Kane's description of the great Humboldt glacier)—of its dispersion over the sea-bed by the action of tides and currents—of the deposit thus formed being inhabited by a variety of animals of a high northern type during a long and quiet course of time—of the sea-bed being elevated by slow degrees above the surface of the water by an agency which we cannot satisfactorily explain, but which may be volcanic, or perhaps caused by steam*—of the consequent extermination of these marine animals—of an interval during which the raised sea-bed was dry land—of a gradual amelioration of the climate—of another oscillation of the earth's crust in a downward direction, when the surface of the land, covered by its former deposit, again became the bottom of the sea—and of a fresh succession of life, which is still in existence. Thus a cycle of similar events continually recurs. Nothing is lost or altogether perishes; all the old materials are used up, and assume new forms. It is the fashion to quote Lucretius. I will only indulge in two lines; they seem not to be inapplicable to the present subject:—

> "Huc accedit uti quicque in sua corpora rursum
> dissoluat natura neque ad nilum interemat res."

The kind assistance of Mr. Alder, Dr. Carpenter, the Rev. A. M. Norman, Messrs. Henry and George Brady, Dr. M'Intosh, and Mr. Peach—all of them experienced zoologists—enables me to supplement this Report with notices of other departments of the invertebrate fauna, which have resulted from the last grant made to me. Several new species, especially among the smaller Crustacea, have occurred; and our knowledge of geographical distribution has been not a little advanced by the work. Mr. Norman's services especially deserve acknowledgment.

I have made my usual contribution to the British Museum.

* *Vide* Mr. R. A. Peacock's pamphlet 'On Steam as the Motive Power in Earthquakes and Volcanoes, and on Cavities in the Earth's Crust.' Jersey, 1866.

Description of a new species of Montacuta.

MONTACUTA TUMIDULA*, Jeffreys.

SHELL rhomboideo-oval, rather gibbous, thin, semitransparent, glossy, and prismatic: *sculpture*, numerous and close-set delicate, microscopical concentric striæ: *colour* yellowish: *epidermis* fine and silky: *margins*, on the posterior side extremely short and sloping downwards, without any of the angularity which characterizes *M. bidentata*; in front gently curved; on the anterior side considerably expanding and rounded; on the back rising towards the anterior end: *beaks* small, calyciform, blunt and prominent, incurved, but not having any indentation below them; they are placed close to the posterior side, which is the shortest and not one-sixth the size of the anterior side: *hinge-line* rectangular, occupying about one-third of the circumference: *cartilage* as in *M. bidentata*: *hinge-plate* narrow and strong, thicker in the middle, not excavated so deeply as in the last-named species, and scarcely at all in the right valve: *teeth*, in the right valve short, triangular, slightly inclining inwards, not widely separated; in the left valve long, erect, laminar, and parallel with the hinge-line; the anterior teeth are the largest in both valves: *inside* iridescent and polished, very finely marked (more distinctly on the anterior side) with slight lines which radiate from the beaks: *scars* irregularly oblong, conspicuous. L. 0·075. B. 0·1.

HABITAT. Muddy ground in the Minch off the north-west coast of Ross-shire, in 50–60 fathoms. I there found only a single dead specimen; but twenty years ago I dredged another in Skye, which I deferred noticing until I was quite satisfied of its differing from *M. bidentata*. [Since this Report was presented, Mr. Dawson has found two more specimens in some of the dredged sand which I had sent him.] Among the shells procured by Professor Lilljeborg in Bohuslän, on the south coast of Sweden, I observed two or three specimens of the present species, one of which he kindly gave me.

This shell is smaller than *M. bidentata*; it may also be distinguished from that species by its narrower shape, being convex instead of compressed, having a glossy surface, and by the posterior side being extremely small, with almost a perpendicular truncation. That side in *M. bidentata* is invariably squarish, and more or less angulated. The teeth in the right valve of *M. tumidula* are much smaller, and less widely separated by the

* Somewhat swollen.

cartilage-pit; they are triangular instead of leaf-like, and slightly incline inwards instead of being erect.

M. truncata of Searles Wood, from the Coralline Crag, is a comparatively large, squarish, and flattened shell, and has long cardinal teeth.

L.—*On* Hyalonema mirabilis, *in reply to Dr. Gray.* By Dr. Bowerbank.

In the 'Annals and Magazine' for October 1866, p. 287, Dr. Gray has published a note "On the 'Glass-rope' *Hyalonema*," in which he has criticised the short observations on that genus in the first volume of my Monograph of the British *Spongiadæ*. Those observations were never meant to be taken as a history of the anatomy and physiology of that curious animal, but simply as an introduction to the genus *Hyalonema* among the Sponges, and as a reason for figuring the numerous interesting forms of its siliceous spicula among those of various other species of Sponges. The detailed account of these organs, except as far as it was necessary to illustrate the specimens selected for figuring, was reserved for a paper shortly to be published, and especially devoted to a minute investigation of the whole of the organization of the animal, including the basal mass of sponge-tissue, the spiculous axis, or rope, and its coriaceous envelope, with a view to establish the organic unity of these parts as portions of one and the same animal.

The criticisms of Dr. Gray are therefore somewhat premature; and in some respects he has so far misrepresented my opinions as to render a reply to his observations necessary. But in thus answering his remarks it must be understood that I shall not at present attempt to decide the questions in dispute, as to whether it be a single animal or two animals, the one parasitical on the other, and that I shall reserve the structural proofs and the reasonings necessary to such a decision for a paper on the subject, which I have long had in preparation and which I hope shortly to be able to publish.

In page 289 Dr. Gray writes, "Again, the specimens being sunk in a sponge that had a flat base by which it was attached to some marine body, I concluded that the natural habit of the animal was to develope itself in a sponge, so as to support itself in an erect position; and this idea was strengthened by finding that the sponge near the part where the coral perforated it was of a more condensed and harder texture than the other parts of it. I concluded that there was a kind of mutual understanding (such as we often find between animals that are parasitic on one